IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Applicant: New	Art Unit: 2189
Serial No.: 10/674,081	Examiner: Peikari
Filed: September 29, 2003	HSJ920030174US1
For: LOG-STRUCTURED FILE SYSTEM FOR DISK DRIVES WITH SHINGLED WRITING	February 11, 2008 750 B STREET, Suite 3120 San Diego, CA 92101

SUPPLEMENTAL APPEAL BRIEF

Commissioner of Patents and Trademarks

Dear Sir:

This supplemental appeal brief is submitted in response to the attempt to reopen prosecution dated February 6, 2008. The attempt is declined, and the appeal is hereby reinstated.

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(1) Real Party in Interest

The real party in interest is Hitachi Global Storage Technologies, Netherlands, B.V.

(2) Related Appeals/Interferences

No other appeals or interferences exist which relate to the present application or appeal.

(3) Status of Claims

Claims 1-4, 6-13, 15, 16, and 18-25 are pending and finally rejected, which rejections are appealed, and Claims 5, 14, and 17 have been canceled.

(4) Status of Amendments

No amendments are outstanding.

(5) Summary of Claimed Subject Matter

As an initial matter, it is noted that according to the Patent Office, the concise explanations under this section are for Board convenience, and do not supersede what the claims actually state, 69 Fed. Reg. 155 (August 2004), see page 49976. Accordingly, nothing in this Section should be construed as an estoppel that limits the actual claim language.

Claim 1 sets forth a hard disk drive (HDD) with a rotatable disk (reference numeral 12, figure 1; page 5, line 15) and a write element (14, figure 1; page 5, line 16) configured for writing data to the disk in isolated tracks and in bands composed of two or more tracks. A controller (28, figure 1; page 6, line 2) controls the

write element and uses a log-structured file system (figure 3, page 9) defining segments, with each segment corresponding to a respective band and/or an isolated track. The log-structured file system uses an error correction code (ECC) block size that is larger than a physical sector size of the disk, and a cumulative ECC parity state between successive partial writes of an ECC block is retained (page 4, lines 2-4).

Claim 10 recites a data storage system with disk means (reference numeral 12, figure 1; page 5, line 15) for storing data, means (14, figure 1; page 5, line 16) for writing data to the disk in tracks and bands, wherein at least two tracks establish a band and wherein at least some bands are shingled, and means (28, figure 1; page 6, line 2) for controlling the means for writing. The means for controlling uses a log means (figure 3, page 9) for establishing a file system, and the log means uses a virtual address table (VAT) (58, figure 4; page 11, line 4) to remap sectors as required for shingled track writing.

Claim 18 sets forth a redundant array of independent disks (RAID) system including a RAID controller (page 11, lines 10-12) and a plurality of hard disk drives (10, figure 1; page 5, line 14). Each disk drive includes at least one storage disk (reference numeral 12, figure 1; page 5, line 15) and at least one drive controller (28, figure 1; page 6, line 2) reading data from and writing data to the disk. The drive controller for each disk drive is coupled to the RAID controller. The drive controller for each drive writes data in shingled bands using a log-structured file system (figure 3, page 9).

(6) Grounds of Rejection to be Reviewed on Appeal

(a) Claims 1, 2, and 4 have been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al., USPP 2002/0071198 in view of Rosenblum et al. (non-patent publication submitted by Appellant) and Asano et al., USPP 2003/0147167.

(b) Claim 3 has been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Asano et al., and Payne et al., USPN 6,212,047.

(c) Claims 6-8 have been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Asano et al., and Ono et al., USPN 5,872,905.

(d) Claim 9 has been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Asano et al., Ono et al., and Holland et al., USPN 5,367,669.

(e) Independent Claim 10 and dependent Claims 11, 15, and 16 have been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al. and Ono et al.

(f) Claim 12 has been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Ono et al., and Payne.

(g) Claim 13 has been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Ono et al., and Asano et al.

(h) Independent Claim 18 and dependent Claim 19 have been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al. and Holland et al.

(i) Claim 20 has been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Holland et al., and Payne.

(j) Claim 21 has been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Holland et al., and Asano et al.

(k) Claims 22-25 have been rejected under 35 U.S.C. 103 as being unpatentable over Liu et al. in view of Rosenblum et al., Holland et al., and Ono et al.

(l) Claims 1-4 and 6-9 have been rejected under 35 U.S.C. §112, second paragraph for being allegedly indefinite.

(7) **Argument**

a. Obviousness Rejection of Claims 1, 2, and 4

Of relevance to amended Claim 1 is the allegation that Asano et al., paragraphs 107 and 108 teaches an error correction code (ECC) block size larger than a physical sector size of the disk, with a cumulative ECC parity state between successive partial writes of an ECC block being retained. This is wrong. Paragraph 108 indeed teaches a "long block" ECC that includes "N" 512 byte sectors in which the check bytes of multiple encoders are summed to generate shared check bytes, but then immediately distinguishes its method from an integrated interleaving technique by observing that the Asano et al. method works by summing check bytes, not data bytes.

There is no mention at all in paragraph 108 of Asano et al. of parity, much less that a cumulative ECC parity state between successive partial writes of an ECC block is retained as is otherwise recited in Claim 1. Indeed, because parity typically involves XORing "N" data bytes (not check bytes) to generate an extra (N+1) byte that subsequently can be combined with surviving data bytes to resurrect a lost data byte, paragraph 108 of Asano et al., which focusses on check bytes, plainly fails to implicate parity at all, much less in the way set forth in Claim 1. Apart from this, Appellant has been able to discern nothing in Asano et al. about successive partial writes, much less retaining anything between them, much less still retaining a cumulative ECC parity state. The rejections under this section merit reversal.

In addition, while Rosenblum has been used for a teaching of a log-structure file system, nothing has been pointed to that the prior art recognizes using such a system either for the use of Liu, or as a vehicle that uses the ECC system of Asano. Indeed, no evidence has been produced that such a recognition existed prior to the recognition in the present specification on page 8 that such a log structure might find use in the context of Claim 1. Instead, on pages 8 and 9 of the Office Action all that appears by way of a rationale to combine the log structure of Rosenblum with Liu is a weak reference to portions of Rosenblum about faster file writing and crash recovery without ever discussing why the skilled artisan might believe that these features would be desired or even achievable in the very different context of Liu.

In other words, the rejections utterly fail to explain why, specifically, the skilled artisan would believe that a HDD controller might use a log-structured file system defining segments that correspond to respective bands and/or tracks, when the system of Rosenblum appears to discuss neither and in fact mentions only a disk with segments and not that the segments define bands or tracks on page 4, right hand column. The proferred rationale - that tossing Rosenblum into Liu would achieve faster operation and fault recovery - are pure conjecture. Whether Rosenblum would indeed result in the hypothetical improvements to Liu rests on sheer speculation, unless one has the present specification handy and is willing to peek at it in hindsight as a roadmap in reconstructing the invention from references that do not enable, teach, or suggest what is being claimed.

The claims recite more than a mechanical invention with elementary parts whose uses and applications might be understood without reference to a considerable store of technical details as was the case in KSR Int'l Co. v. Teleflex Inc., 127 S.Ct. 1727 (2007). Quite the contrary. Absent any technical evidence of record, how does the examiner know that a specific data structure would improve the operation of a type of data writing

nowhere envisioned for use with the data structure - as opposed to impede operation in actual implementation? Sorting such things out in complex technologies is the stuff that inventions are made of.

In this regard, page 23 of the Office Action reflects a misunderstanding as to burden of proof. More particularly, having concocted an unsupported reason to combine without any evidence of record showing prior art teachings or suggestions or known knowledge on the part of the skilled artisan to validate it, the examiner challenges Appellant to disprove the unsupported conjectures. However, absent use of the present specification as a guide, no evidence can be pointed to of record that the conjectures are true, or would have been recognized as such. No burden ever shifts away from a *prima facie* case that is illegitimately made.

Continuing with an exposition of the plucking of isolated unrelated teachings from the prior art that has characterized prosecution, nothing has been pointed to in Rosenblum to use an error correction code (ECC) block size larger than a physical sector size of the disk as recited in Claim 1, nor has any mention been pointed to in Asano et al. that might conceivably tie its ECCs to a log-structured file system. The only place that combination is remotely suggested is in Claim 1. All the examiner has done is in effect lifted statements from the references extolling their benefits in contexts that are different from the proposed combination advanced in the Office Action.

The latest Office Action has nothing of substantive materiality to add to the former examiner's contentions until line 4, page 22, mischaracterizing what Appellant has argued. Specifically, the new examiner alleges that Appellant "suggests that well known aspects of data processing systems such as log-structured files and virtual address tables were not, in fact well known", embarking on a historical tour-de-force of computing in the early 1980s.

However entertaining the retort in the Office Action was meant to be, it is a straw man. Appellant *never* said that log-structured files and virtual address tables standing alone were not known, and Appellant acknowledged as much ***since this application was filed, see, e.g., the first paragraph of page 8 of the specification, discussing Rosenblum.*** What Appellant observed there and subsequently was that such structures had not been used in shingle track writing to the best of Appellant's knowledge, i.e., that log-structured file systems had not been used ***in the combination claimed.*** It is troubling that such a clear, good faith exposition of the prior art on the face of the patent application and subsequently has been so baldly distorted by an ostensibly fair and impartial examiner.

The Office Action next makes an unsupported allegation that parity is a type of ECC without resorting to explanations as to why one skilled in the art would use the term "ECC" to mean "parity", insufficiently establishing the point under MPEP §2111.01.

The Office Action also declares that "all bytes are data bytes" and that therefore any distinction between check bytes and data bytes is meaningless, apparently without reading Asano et al., which, as stated above, decidedly distinguishes its method as summing check bytes, not data bytes: "the ML-ISF-ECC process generates the ISF shared check bytes among N distinct 512 byte sectors ***by summing stored check bytes and not the data bytes***" (emphasis mine). In crafting its argument for patentability, Appellant has merely taken the examiner's reference at its word; the examiner in effect takes a position that is in direct contradiction with what his own reference inconveniently teaches for purposes of carrying his case.

b. Obviousness Rejection of Claim 3

Claim 3 inherits the patentability of its base claim.

c. Obviousness Rejections of Claims 6 and 8

Claims 6 and 8 inherit the patentability of their base claims.

d. Obviousness Rejection of Claim 9

Claim 9 inherits the patentability of its base claim.

e. Obviousness Rejection of Claims 10, 11, 15, and 16

Of relevance to amended independent Claim 10 is the allegation in the Office Action that because Ono et al. teaches a VAT, and because Rosenblum et al. teaches a log, it would have been obvious to modify Liu et al. to arrive a log means that uses a virtual address table (VAT) to remap sectors as required for shingled track writing. For reasons advanced above, this rejection appears to impermissibly pluck isolated teachings from disparate references to arrive at amended Claim 10, because (1) the relied-upon VAT in Ono et al. is not used by a log, nor is there any suggestion that it be used in a log structure; and (2) the relied-upon log structure in Rosenblum et al. is not used in shingled writing as indeed spelled out on page 8, lines 7-9 of the present specification, nor is there any suggestion to do so.

Thus, to arrive at the claims, the rejections have found it necessary to allege, contrary to what the present specification teaches about Rosenblum et al. and without any prior art evidence of support, that Rosenblum et al.'s log can be used in shingled track writing. Then, the rejections must make a second order leap, making an unsupported observation that the VAT in Ono et al. can be used in a log despite Ono et al. nowhere appearing to mention the word "log" at all. Claim 10 and its dependent claims are patentable.

Although owing to the attempted reopening the SPE and the new examiner could have offered a rebuttal to Appellant's observation about Ono, they deliberately chose not to, conceding the observations.

f. Obviousness Rejection of Claim 12

Claim 12 inherits the patentability of its base claim. Furthermore, one or more of the arguments above might apply *mutatis mutandis* to the rejections under this ground of rejection.

g. Obviousness Rejection of Claim 13

Claim 13 inherits the patentability of its base claim. Furthermore, one or more of the arguments above might apply *mutatis mutandis* to the rejections under this ground of rejection.

h. Obviousness Rejections of Claims 18 and 19

Because the Office Action fails to rebut, using evidence from the prior art or evidence as to the general knowledge in the art regarding shingled track writing, the teachings of the present specification that a log-structured file system as taught in Rosenblum et al. has not heretofore been suggested for use in shingled track writing, Claim 18 and it dependent claims are patentable. The only response the examiner has been able to muster to this argument on page 20 of the Office Action is the above-noted irrelevant argument concerning "intended use."

i. Obviousness Rejection of Claim 20

Claim 20 inherits the patentability of its base claim. Furthermore, one or more of the arguments above might apply *mutatis mutandis* to the rejections under this ground of rejection.

j. Obviousness Rejection of Claim 21

Claim 21 inherits the patentability of its base claim. Furthermore, one or more of the arguments above might apply *mutatis mutandis* to the rejections under this ground of rejection.

k. Obviousness Rejections of Claims 22-25

Claims 22-25 inherit the patentability of their base claims. Furthermore, one or more of the arguments above might apply *mutatis mutandis* to the rejections under this ground of rejection.

l. Indefiniteness Rejections, Claims 1-4 and 6-9

The rationale behind these rejections is that "a cumulative ECC parity state between successive partial writes of an ECC block is retained" is vague and unexplained, and that it is unclear how a "state" can be "cumulative".

The PTO has established on the written record, however, that until the most recent office action it found the complained-of terms to be quite clear and definite, offering, by way of comparison to prior art teachings, a construction of what the PTO regarded the terms to mean on May 31, 2007 (Office Action, page 11, paragraph 20) and again, on July 11, 2007 (Office Action, page 7, third paragraph).

Furthermore, the complained-of term is not "insolubly ambiguous" as it must be to support an indefiniteness rejection under MPEP §2173.02:

> "The essential inquiry pertaining to this requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language must be analyzed, not in a vacuum, but in light of:
>
> (A) The content of the particular application disclosure;
> (B) The teachings of the prior art; and
> (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.
>
> "In reviewing a claim for compliance with 35 U.S.C. 112, second paragraph...only when a claim remains insolubly ambiguous without a discernible meaning after all reasonable attempts at construction must a court declare it indefinite."

Applying this guidance to the rejection at hand, Appellant notes that the second and third of the above considerations have been ignored. All that is alleged by way of rationalizing the allegation is a rhetorical question. Rhetorical questions are no substitute for MPEP analysis.

However, in the interest of the Board's time, Appellant will complete the analysis. When no specific definition is given to a claim term in the specification, the term assumes its ordinary and accustomed meaning in the art, Phillips v. AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Absent a special meaning in the art, dictionaries may be consulted, id. Accordingly, turning to Webster's New World Compact School and Office Dictionary, Simon & Schuster (1989), "cumulative" means "increasing in effect, size, by successive additions", and indeed, the present specification, page 8, teaches that "large error correction (ECC) block sizes within each segment (band) are implemented by storing the intermediate ECC parity state after each partial write of an ECC block." Thus, the intermediate states are stored after each write to arrive at large ECC block

sizes. When read in light of the specification and the relevant dictionary meaning of the modifier of the term "cumulative", it can hardly be said that the meaning of the complained-of phrase remains "insolubly ambiguous".

Respectfully submitted,

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JLR:jg

APPENDIX A - APPEALED CLAIMS

1. A hard disk drive (HDD) comprising:

at least one rotatable disk;

at least one write element configured for writing data to the disk in isolated tracks and in bands, wherein at least two tracks establish a band; and

at least one HDD controller controlling the write element, the controller using a log-structured file system defining segments, each segment corresponding to at least one of: a respective band, and an isolated track, wherein the log-structured file system uses an error correction code (ECC) block size larger than a physical sector size of the disk, a cumulative ECC parity state between successive partial writes of an ECC block being retained.

2. The HDD of Claim 1, wherein at least some bands include at least three contiguous tracks.

3. The HDD of Claim 1, wherein the write element is configured for perpendicular recording.

4. The HDD of Claim 1, wherein the tracks within a band are shingled.

6. The HDD of Claim 1, wherein the log-structured file system uses a virtual address table (VAT) to implement shingled track writing.

7. The HDD of Claim 6, wherein the VAT maps virtual sector locations to actual sector locations.

8. The HDD of Claim 6, wherein the VAT is stored on the disk in at least one of: a location with non-overlapping tracks where random access writes can be performed, and a region with shingled written bands, using a log structured storage approach.

9. The HDD of Claim 6, wherein the HDD is part of a RAID system including a RAID controller, the RAID controller accessing the VAT to remap sectors as required for shingled track writing.

10. A data storage system comprising:

disk means for storing data;

means for writing data to the disk in tracks and bands, wherein at least two tracks establish a band and wherein at least some bands are shingled; and

means for controlling the means for writing, the means for controlling using a log means for establishing a file system, wherein the log means uses a virtual address table (VAT) to remap sectors as required for shingled track writing.

11. The system of Claim 10, wherein at least some bands include at least three contiguous tracks.

12. The system of Claim 10, wherein the means for writing is configured for perpendicular recording.

13. The system of Claim 10, wherein the log means uses an error correction code (ECC) block size larger than a physical sector size of the disk means, a cumulative ECC parity state between successive partial writes of an ECC block being retained.

15. The system of Claim 10, wherein the VAT maps virtual sector locations to actual sector locations.

16. The system of Claim 10, wherein the VAT is stored on the disk means in at least one of: a location with non-overlapping tracks where random access writes can be performed, and a region with shingled written bands, using a log structured storage approach.

18. A redundant array of independent disks (RAID) system comprising a RAID controller and a plurality of hard disk drives, each disk drive including at least one storage disk and at least one drive controller reading data from and writing data to the disk, wherein the drive controller for each disk drive is coupled to the RAID controller, the drive controller for each drive writing data in shingled bands using a log-structured file system.

19. The RAID system of Claim 18, wherein at least some bands include at least three contiguous tracks.

20. The RAID system of Claim 19, wherein the disk drives are configured for perpendicular recording.

21. The RAID system of Claim 19, wherein the log-structured file system uses an error correction code (ECC) block size larger than a physical sector size of a disk, a cumulative ECC parity state between successive partial writes of an ECC block being retained.

22. The RAID system of Claim 19, wherein the log-structured file system uses a virtual address table (VAT) to implement shingled track writing.

23. The RAID system of Claim 22, wherein the VAT maps virtual sector locations to actual sector locations.

24. The RAID system of Claim 22, wherein the VAT is stored on the disk in at least one of: a location with non-overlapping tracks where random access writes can be performed, and a region with shingled written bands, using a log structured storage approach.

25. The RAID system of Claim 22, wherein the RAID controller accesses the VAT to remap sectors as required for shingled track writing.

APPENDIX B - EVIDENCE

None (this sheet made necessary by 69 Fed. Reg. 155 (August 2004), page 49978.)

APPENDIX C - RELATED PROCEEDINGS

None (this sheet made necessary by 69 Fed. Reg. 155 (August 2004), page 49978.)